4. ENVIRONMENT

MINERAL RESOURCES

Purposes of this Section

It is important to know historically where mining occurred in the past, where mining is suitable in the present, and where potential mining sites may be in the future. Future mineral resource expansion can add to the tax base, provide jobs and may offer post-mining recreation sites. By recognizing the mineral resources available for Culpeper County, it becomes easier to plan for these resources that are important to the developing community. The most suitable areas for mineral resource mining are usually unsuitable for drain fields and agricultural uses. Specific quarry site selection requires detailed investigations, including evaluation of terrain, accessibility, rock quality, zoning and land-use ordinances, and environmental impacts.

History

Culpeper County is located within the Northern Piedmont and Blue Ridge Major Land Resource Areas (Land Resource Regions and Major Land Resource Areas of the United States, USDA, NRCS, 1981) and is underlain by igneous, sedimentary, and metamorphic rocks (see Map 4.A, Geology). These areas are bordered by the North Appalachian Ridge Valley to the west and the North Coastal Plain to the east.

The Triassic-Jurassic Basin, also known as the Culpeper Basin, is the dominant feature of Culpeper County's geology and stretches from the mid-eastern portion of the County diagonally to the southern tip (see Map 4.A1). The rocks in this basin are Triassic-Jurassic red and brown shales, siltstones, and sandstones intruded by diabase. The types of rocks within this region include sandstone, siltstone, shale, hornfels, diabase, basalt, limited coal seams in some areas, and conglomerate. Groundwater quality in this basin is generally lower because of hardness, acidity, salinity, and iron.

Culpeper County has a varied history of mining efforts. In the mid to late 1800's, copper was found near Slaughter's mountain. The Virginia Department of Mines, Minerals and Energy has identified three mines that contain small deposits of copper: the Batna Mine, Culpeper Prospect, and Ellis Mine. Copper mineralization associated with Triassic rocks near Culpeper and Batna have been prospected but no commercial production was established.

Gold was first found in Culpeper County around 1828. The gold deposits that were found, and may still exist today, are located in a 150 mile long by a 10 to 15 mile wide strip which runs from Montgomery County, Maryland to Appomattox County, Virginia. This linear region contains scattered occurrences of pyrite and gold. Gold ore was mined and milled at several sites in the vicinity of Richardsville in the eastern part of the County. Known gold deposits tend to be relatively low grade with low concentrations of fine flakes. In addition, soapstone has also been found near Richardsville.

TABLE 4. I
GEOLOGY OF CULPEPER

GEOLOGIC AGE	ROCK UNITS	DRILLED WELL DATA
JURASSIC:	***DIABASE:*** DIKES, SILLS, AND THERMALLY-METAMORPHOSED SEDIMENTARY ROCKS WHICH EXHIBIT CHARACTERISTICS SIMILAR TO DIABASE AND BASALT LAVA FLOWS.	43 WELLS; MEAN DEPTH = 480' MODE DEPTH = 450' MEAN STATIC LEVEL = 40' MEAN YIELD = 3.7 GPM
TRIASSIC:	***FINE-GRAINED SEDIMENTARY ROCKS:*** SANDSTONE, SILTSTONE, SHALE AND ARGILLITE.	77 WELLS; MEAN DEPTH = 205' MODE DEPTH = 180' MEAN STATIC LEVEL = 18' MEAN YIELD = 16 GPM
TRIASSIC:	***GREENSTONE CONGLOMERATE***	66 WELLS; MEAN DEPTH = 160' MODE DEPTH = 150' MEAN STATIC LEVEL = 15' MEAN YIELD = 40 GPM
LATE PRECAMBRIAN --PALEOZOIC:	***MAFIC DIKES:*** METABASALT, METAGABBRO, AND META-PYROXENITE.	4 WELLS; MEAN DEPTH = 318' MODE DEPTH = NONE MEAN STATIC LEVEL = 20' MEAN YIELD = 28 GPM (1@60)
LATE PRECAMBRIAN --PALEOZOIC:	***METAMORPHOSED SEDIMENTARY AND IGNEOUS ROCKS:*** PHYLLITE, SCHIST, AND GNEISS, AND COLUMBIA GRANITE AND QUARTZ DIORITE.	78 WELLS; MEAN DEPTH = 415' MEAN DEPTH = 390' MEAN STATIC LEVEL = 30' MEAN YIELD = 4.2 GPM
LATE PROTEROZOIC:	***CANDLER FORMATION:*** PHYLLITES, MINOR MICACEOUS SANDSTONES AND STONES, MARBLE, LIMESTONE AT TOP OF UNIT.	
LATE PROTEROZOIC:	***CATOCTIN FORMATION:*** MASSIVE METABASALTS AND FLOW BRECCIA, INTERBEDDED ARKOSIC AND GRAYWACKE QUARTZITES.	314 WELLS; MEAN DEPTH = 465' MODE DEPTH = 480' MEAN STATIC LEVEL = 20' MEAN YIELD = 3.6 GPM
LATE PROTEROZOIC:	***LYNCHBURG GROUP:*** CHARLOTTESVILLE FORMATION, FINE-GRAINED META-SILTSTONES AND META-ARKOSE; ROCKFISH FORMATION, META-GRAYWACKE AND META-GRAYWACKE CONGLOMERATES; MONUMENTAL MILLS FORMATION, META-SILTSTONE AND META-GRAYWACKE; FAUQUIER FORMATION, META-ARKOSE AND META-ARKOSE CONGLOMERATES.	691 WELLS; MEAN DEPTH = 265' MODE DEPTH = 300' (37 WELLS) MEAN STATIC LEVEL = 26' MEAN YIELD = 7.3 GPM
	JOHNSON MILL FORMATION: CARBON-RICH PHYLLITES AND GRAPHITIC SCHISTS. (WELL QUALITY=POOR, OFTEN VERY HIGH IN IRON AND SULPHUR; LOW Ph.	104 WELLS; MEAN DEPTH = 280' MODE DEPTH = 230' MEAN STATIC LEVEL = 20' MEAN YIELD = 5.6 GPM
	MECHUMS RIVER FORMATION: METAMORPHOSED SANDSTONES, ARKOSES, SCHISTS AND PHYLLITES.	6 WELLS; MEAN DEPTH = 320' MODE DEPTH = NONE MEAN STATIC LEVEL = 25' MEAN YIELD = 6 GPM
MIDDLE PROTEROZOIC:	***ROBERTSON RIVER FORMATION:*** GRANITES, SYENITES AND SUB-VOLCANIC FELSITES.	61 WELLS; MEAN DEPTH = 327' MODE DEPTH = 410' (7 WELLS) MEAN STATIC LEVEL = 20' MEAN YIELD = 6.3 GPM
MIDDLE PROTEROZOIC:	***LOVINGSTON COMPLEX:*** FLINT HILL GNEISS, AMISSVILLE GRANITE AND AUGEN GNEISS.	218 WELLS; MEAN DEPTH = 362' MODE DEPTH = 390' MEAN STATIC LEVEL = 37' MEAN YIELD = 11.3 GPM

In the past, diabase, basalt, granitic rocks, sandstone, hornfels, and conglomerate have been quarried as sources of crushed stone. Limestone was quarried near Jennings Store for use as agricultural stone, and limestone from other parts of the County has also been burned to produce lime. Slate has been quarried and other types of rock have been used for local construction purposes. Clay materials were formerly produced for use in brick plants at Culpeper and Elkwood, and for use in the manufacture of brick and tile at Stevensburg. Samples of clay materials have been tested and found potentially suitable for use in brick and tile. Sand obtained in the Hazel River area has been used for paving, masonry, concrete, and ice control. Sand and gravel deposits suitable for construction are present along the Robinson, Rappahannock, and Rapidan Rivers.

Current Activity

During 2003, more than 2.4 million tons of stone products were produced in the County. This was an increase of approximately 87% from the preceding year. Stone products in Culpeper are crushed stone and dimensional or block stone from various quarries, primarily Cedar Mountain Stone Corp., Dalrymple Realty Corp., and Luck Stone Corp. which supply crushed stone. Diabase is quarried near Buena, south of Culpeper, by Buena Black Granite Corporation, Rockwell Granite Corporation, Granite Managers, Virginia Mist Corp., and New England Stone Industries, all of which market dimension stone for monument and architecture. Cedar Mountain Stone has also recently opened a site on their property for dimension stone production. The quarry site of Martin Marietta Materials, Inc. was purchased by Luck Stone Corp. in 2002.

Stone Production in Culpeper County

	2002	% Change	2003
Crushed Stone Producers:			
Cedar Mountain Stone Corp.	*		960,991
Dalrymple Realty Corp.	712,331	-79	152,933
Luck Stone Corp.	407,983	59	648,838
Martin Marietta Materials, Inc.	160,000		*
Dimension Stone Producers (Stone Blocks):			
Buena Black Granite Corp.	3,519	132	8,169
New England Stone Industries	8,769	608	62,080
Granite Managers, Inc.	10,714		*
Rockwell Granite Corp.	*		602,845
Virginia Mist	*		*
County Stone Production Total	1,303,316	87	2,435,856

Notes:

Production units are in standard tons

** Production figures are not available*

In 1999,the preliminary estimated value of nonfuel mineral production for Virginia was $667 million, according to the U.S. Geological Survey (USGS). This was a 5% increase from that of 1998, and followed a 7.6% increase from1997 to 1998. For the fourth consecutive year,

Virginia was 22nd in rank among the 50 states in total nonfuel mineral production value, of which the state accounted for more than 1.5% of the U. S. total.

Crushed stone, Virginia's leading nonfuel mineral, accounted for 61% of the State's total value. From 1990 through 1998, Virginia produced more than 558 million metric tons of crushed stone, or an average of almost 56 million metric tons per year. In 1999, the increased values of crushed stone (up $17 million), zirconium concentrates (up more than $5 million), and construction sand and gravel and lime (each up $2.5 million) accounted for a large majority of the states increase. Portland cement, feldspar, vermiculite, masonry cement, and titanium concentrates (from ilmenite) had smaller yet significant increases; talc, gypsum, and gemstones values also rose slightly (all in descending order of change). There were no significant decreases in value of any mineral commodity. In 1998, crushed stone with a $13 million increase, fuller's earth rising almost as much, and significant increases for titanium concentrates and portland cement accounted for a large majority of the State's increase in value. Smaller yet significant increases also occurred in the values of lime and construction sand and gravel, whereas decreases totaling about $9 million occurred in kyanite, dimension stone, masonry cement, and vermiculite.

Excerpted from The Mineral Industry Of Virginia *prepared as a Memorandum of Understanding between the U.S. Geological Survey and the Virginia Department of Mines Minerals and Energy, 1999.*

The Culpeper Basin

The Culpeper Basin is a structural trough filled with sedimentary, metamorphic, and igneous rocks of Mesozoic age that border the eastern front of the Blue Ridge in northern Virginia. The basin extends from the Rapidan River near Madison Mills, Virginia, northeastward across the Potomac River and terminates just west of Frederick, Maryland.

The rock and mineral resources of the Culpeper basin are presently used for construction material, highway fill and building stone. The principal quarries, pits, mines, and prospects are shown on Map 4.A2. Diabase is quarried for crushed aggregate and dimension stone, basalt is quarried for aggregate and crushed stone, and shale is extracted as a source of clay for brick manufacture. Future construction may require adequate quantities of crushed stone, brick clay, and aggregate at or near the surface and close to the area of use. Large reserves of some industrial materials are present, but new pits or quarries may be needed to fulfill the requirements economically before future construction commences. Inactive mineral producers include granite quarries, limestone quarries, and gneiss quarries.

Resources: What is in Culpeper County & Where it is found

Mineral commodities are present in substantial quantities in Virginia: State production figures for 1990 through 1998 indicate that 558 million metric tons of crushed stone or an average of 56 metric tons per year were produced. In the years 1997, 1998 and 1999 Virginia produced a total of 34.8 million tons of sand and gravel, averaging approximately 11.6 million tons per year, for an average of $54.9 million per year. Production of clays for the same time frame averaged approximately 860,000 tons for an average of $3.2 million per year within the Commonwealth of Virginia. Each of these resources is described in detail in the following paragraphs.

Gneiss material is a foliated metamorphic rock that corresponds in composition to granite or feldspathic plutonic rock**.** This type of rock is found primarily in the northwestern to southwestern region of the County. There exists a small amount in the eastern region of the County. Crushed stone, road material, rip-rap, and dimension stone are the types of rock found in this region of the County.

Diabase is a fine to medium textured, dark igneous rock suitable for crushed stone that underlies large areas of the Culpeper Basin at shallow depths. This material produces aggregate of excellent quality because it is tough, with uniform texture, and resistant to chemical weathering. This rock is readily quarried because of the ability for splitting and removal facilitated by an intersecting network of closely to moderately spaced joints. Crushed diabase is used primarily as binder/filler for asphalt paving, base course for highways, road material, rip-rap and concrete aggregate. Diabase for dimension stone and ornamental stone is also quarried. This material includes dimension and monument stone (black granite), copper and iron containing ores found in fractures (chalcopyrite, magnetite, specularite, bornite, malachite), and some amethyst. Diabase is generally found diagonally in the eastern portion of the County, east of the Town of Culpeper and west of Lignum.

Thermally metamorphosed zones, or hornfels, form a belt of altered sedimentary rocks that surround diabase bodies in the Culpeper Basin. These include Triassic siltstone and shale, which have been produced locally as a source of fill and roadbed material, and also very small, scattered coal seams. The hornfels material is quarried for crushed stone, aggregate, rip-rap, dimension and monument stone, and brick and tile material. Engineering tests are required at potential quarry sites in order to ascertain whether these rocks have the required characteristics for their intended use.

Hornfels material also contains some metallic and nonmetallic ores, such as copper and iron ores, and barite. These ores are found in small quantities in fissure fillings along the perimeter of the diabase intrusions in the Culpeper Basin. Minor disseminated copper occurrences have been found near Batna. Copper ore has been mined near Brandy and Cedar Mountain*.*

Magnetite and specular hematite are commonly associated with copper minerals, as well as barite and pyrite. The most common type of occurrence is in or near thermally metamorphosed zones surrounding diabase where heat apparently converted disseminated hematite and limonite to specularite and magnetite. Iron, copper, lead, arsenic, and zinc containing ores occur along the Rapidan River. Gold may be included in some of the lead ores.

Triassic conglomerate material is used for road fill. This material is found in smaller quantities along the perimeter of the Culpeper Basin.

The Goldvein material extends into Culpeper County. This material is located in the eastern region of the County east of Richardsville along the Rappahannock River. The Goldvein pluton includes gold, iron bearing ore, quartz monzonite for crushed stone, aggregate, and road fill.

Areas containing soils high in vermiculite and gibbsite are found along the eastern portion of the County, east of Lignum and in the vicinity of Richardsville. Some areas along the Rappahannock River contain blue quartz that is high in titanium. There is a small area that may contain marble in an outcropping that is north along the Metabasalt region.

Sand and gravel from floodplain soils are scattered throughout the County. Some of these materials were formerly extracted from pits in the northern part of the basin, but no pits have been active from 1980 to the present.

Opals from quarrying activities have been found along the Rapidan River near Rapidan. Placer gold from the Rapidan River has been found but exact locations are unknown.

Broad areas in the northwestern part of the Culpeper Basin are underlain by impure limestone conglomerate associated with red sandstone and siltstone. Limestone for agricultural lime is found near Jennings Store. The local material has not been used for many years because of its impurities, limited outcroppings, and the availability of quality sources.

Commercial clay deposits are known and deposits of clay which have commercial potential are common in fresh and weathered shale in the Culpeper Basin. Red-brown shale and silty shale are dug from clay pits in which the strata are abundant in the Culpeper Basin. Clay analyses indicate that raw materials potentially suitable for the manufacture of common brick and terra cotta pipe and tile products are abundant. Light to dark gray slightly calcareous shale and silty shale are less common than red-brown shale. Preliminary firing tests by the U.S. Bureau of Mines of samples of gray clay indicate that these rock types are suitable for common brick and light weight aggregate. Material suitable for light weight aggregate is relatively rare.

Clay material samples collected between 1981 and 1984 revealed that there were four sites where clay was found in outcroppings that may be suitable for structural clay products, common brick and tile, and could be mixed with other materials to improve plasticity. .

Culpeper County has a history of uranium prospects. In the late 1970's to early 1980's, a significant number of land leases were obtained, however, only a very limited amount of core drilling was actually done and no use permits for mining of uranium were ever granted. The conglomerate nature of the geology of the Triassic Basin would indicate the presence of uranium and other metals, but extraction did not prove to be economically viable.

What is economically viable

Future needs must be forecasted and analyzed in addition to identifying, inventorying, classifying, and ranking potential sites of adequate size. Sites with economic potential should be protected from preemptive uses. Reclamation plans for sites of depleted resources should consider alternative land uses that take advantage of the topographic, hydrologic, and geologic characteristics of each site.

The Virginia Department of Mines, Minerals and Energy has located four clay deposits in the southeastern part of the County. These deposits may have an economic value for the production of building materials; common brick and tile. According to the Virginia Department of Mines, Minerals and Energy, in 2003, there were eight operating quarries in Culpeper

County. The annual tonnage of granite and sandstone quarried from these operations in 2003 was 602,845 tons.

The maps within this plan show the location of economically available rock and mineral resources. Informed decisions on expected future needs can be made now by local governments, industry, and regulatory agencies to insure that the identified resources will be available when needed. As urbanization expands into areas that are presently rural or undeveloped, potential mineral deposits may be preempted, unless such deposits are recognized and preserved in the land-use planning process. Extraction of rock or clay may be only a temporary stage in the efficient use of land. After extraction, the land can be restored to agriculture or used for recreational areas, building sites, or solid waste disposal.

SITING CRITERIA FOR FUTURE QUARRY AND MINE LOCATIONS:

Access

Transportation is an important aspect of identifying mineral resources potential. Transporting aggregates by truck, after the initial minimum fee, averages about $0.15/ton-mile (fuel figures as of 2004). Access is extremely important to active mineral facilities. The weight and size of the vehicles transporting material demand adequate transportation routes. By siting these facilities along paved roadways with adequate widths, negative traffic impacts can be reduced. Where feasible, the use of railroad sidings should be encouraged. If truck traffic can be reduced through the practice of shipping freight via rail, this should be treated as a substantial benefit.

Compatible surrounding land use

The availability and location of mineral resources is important information for land-use planners, mining and quarrying industries, and the concerned public. Future availability and utilization of rock and mineral commodities is dependent upon the decisions made by planners and other land-use decision makers. In planning for future extraction, the need to reserve adequate space for facilities, access roads, buffer zones, and corridors for high-load electrical lines should be considered. Effective protection of resources remote from urban areas often are dependent upon land use planning efforts which occur before requests are received.

Mineral resource extraction should be compatible with surrounding land uses. Siting facilities in agricultural or rural areas in A-1 and RA zoning districts with very low residential densities is appropriate. Large tracts of land are necessary to provide buffers from the dust, noise, and vibration associated with this industry.

Focus on environmental issues

The decision to utilize an available resource relies upon many external factors, principally economic and environmental concerns. Proper planning and regulation in advance of extraction of resources can minimize and prevent environmental disruption. Plans to extract any type of resource must be weighed against the effects of extraction on scenic values, recreational uses, surface water quality of the rivers and creeks, agricultural operations and residential quality of life.

Mineral resources can be mined only where they are found, thus planning for their potential environmentally sound extraction is the responsibility of the local government. It has been noted by the former U.S. Bureau of Mines that the average American will use:

- 1,600 kg (3,600 lb) of aluminum
- 360 kg (800 lb) of zinc
- 11,300 kg (25,000 lb) of clay
- 25,000 kg (56,000 lb) of steel
- 360 kg (800 lb) of lead
- 680 kg (1,500 lb) of copper
- 12,200 kg (27,000 lb) of salt
- More than 226,000 kg (500,000 lb) of coal
- More than 452,000 kg (1 million lb) of stone, sand, gravel, and cement.

It is easy to see the amount of resources that will be required, but it is important to consider the environmental affects of mining. Mining for sand and gravel or quarrying for different types of stone often occurs near waterways. The Culpeper Basin's southern to southeastern boundary in Culpeper County occurs along the Rapidan River. Environmental degradation may occur if proper planning and design techniques are not utilized. As such, all use permit applications for mineral extraction should include documentation which insures environmental protection.

Case by case consideration via conditional use permit

Mining, excavation, quarrying, product drilling, and all associated activities of extractive and mining operations are conditionally permitted in the Agricultural (A-1) and the Rural Area, (RA) zoning districts. Consequently, any operation of this type must apply for a conditional use permit. All applications for conditional use permits will be considered on a case by case basis by the Planning Commission and the Board of Supervisors. This process will allow for site-specific studies with proper planning and siting of the facility. Appropriate conditions should be imposed and approval should be given only when it is shown that the surrounding areas will be compatible with this type of land use, and only when the criteria outlined here have been met.

Future Mineral Resource Extraction

Map 4.A3-Future Mineral Resource Extraction is intended to recognize areas where mineral resources exist, where access is adequate, where residential population is low, and where the environment can be protected. In short, it is an indicator of those areas where our mining and quarrying site criteria can most likely be met. It should be utilized as a guideline with more thorough study through the use permitting process, which is required for any application for permission to begin a mineral extraction operation.

SOILS

Since Culpeper County is entirely within the Piedmont Plateau Physiographic Province, the soils of the county are predominantly residual from the decay of underlying bedrock. In the north, northwest, western and central portions of the County, the soils are from acid

crystalline rock materials. A narrow belt of maroon red soils produced from basic igneous rock materials runs northeast from the point where Route 15 enters the County to Lakota on the Rappahannock River. The remaining soils of the County are formed from sandstone, shale and Culpeper County has a variety of soils due to the underlying rock formations. Many of the soils are suitable for agricultural purposes, but have limitations such as steep slopes, susceptibility to wind or water erosion, adverse effects of past erosion, shallow soil depth, unfavorable soil structure and workability, moderate salinity or sodium, and permanent wetness problems that reduce the choice of plants. Many soils require careful soil management and conservation practices to prevent deterioration and maintain productivity. See Table 4.4 for a list of hydric soils associated with wetlands.

There are three methods of classifying significant soils for agricultural and forestal suitability. They are:

- Capability Class,
- USDA Important Farm rating system, and
- LESA (Land Evaluation and Site Assessment)

Capability classifications are based on the productivity potential of each soil. Productivity is determined by soil structure, slope and drainage. Soils with a capability of classes I and II are designated as important farm and forest soils for the County. These soils are suited to a wide range of plant materials and may be used safely for cultivating crops, pasture and woodland. These soils, through good management, have a low erosion hazard and they are deep, generally well drained and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer. Class II soils have slight limitations such as gentle slopes, moderate susceptibility to erosion, occasional flooding and wetness.

The United States Department of Agriculture (USDA-SCS) Soil Conservation Service Farmland rating system classifies soils with the following designations:

Prime Farmland
Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops.

Farmland of Statewide Importance
Land in addition to prime that is of statewide significance for production and identified as such by state agencies (USDA-SCS and Extension Service).

Farmland of Local Importance
Land that has productivity potential that is of local importance and identified as such by local agencies. (USDA-SCS and Extension Service).

Unique Farmland
Land that is used for the production of specific high-value food and fiber crops. Soils with these classifications are considered important soils in Culpeper County.

The LESA system was developed to facilitate protection of farm and forestland based on the quality of land for agricultural uses as determined by soil surveys. The Land Evaluation

portion of the LESA system was also used in determining the soils that should be recognized as important in the County. The LESA system was developed to facilitate protection of farm and forestland based on the quality of land for agricultural uses as determined by soil surveys. The USDA Soil Conservation Service compiled a list of these soils for both Agricultural and Forestal production in Culpeper County in 1983.

The soils that were identified by each of these classification systems were cross-correlated to arrive at a list of significant agricultural and forestal soils in Culpeper County. Table 4.2 provides a list of the significant agricultural and forestal soils and shows that approximately 68,403 acres or 28% of the County have these soils.

TABLE 4.2
SIGNIFICANT AGRICULTURAL AND FORESTAL SOILS

SOIL TYPE	CAPACITY CLASS	SCS CLASS	LESA CLASS		LESA FORESTRY ACRE
AGRICULTURAL SOIL:					
Am-APPLING FINE SANDY LOAM	IIe	PRIME	III PRIME	II	655
Ad-ALBEMARLE FINE SANDY LOAM	IIe	PRIME	III PRIME	II	1,735
Ag-ALTAVISTA LOAM	IIw	PRIME	I PRIME	II	219
Ah-ALTAVISTA LOAM	IIe	PRIME	III PRIME	II	1,071
Ba-BRECKNOCK SILT LOAM	IIe	PRIME	III PRIME	II	2,141
Bc-BUCKS SILT LOAM	IIe	PRIME	II PRIME	II	6,669
Cf-CECIL FINE SANDY LOAM	IIe	PRIME	III PRIME	II	69
Ch-CECIL FINE SANDY LOAM	IIe	PRIME	III PRIME	II	1,035
Cl-CONGAREE FINE SANDY LOAM	IIw	PRIME	I PRIME	I	2,064
Cm-CONGAREE FINE SANDY LOAM	IIw	PRIME	I PRIME	I	3,468
Cv-CULPEPER LOAM	IIe	PRIME	II PRIME	II	3,691
Cx-CULPEPER LOAM	IIe	PRIME	II PRIME	II	1,464
Df-DAVIDSON	IIe	PRIME	III PRIME	II	1,583
Fc-FAUQUIER SILT LOAM	IIe	PRIME	II PRIME	I	412
Hf-HAYESVILLE LOAM	IIe	PRIME	III PRIME	I	445
Ho-HIWASSEE LOAM	IIe	PRIME	II PRIME	II	2,124
Hp-HIWASSEE LOAM	IIe	PRIME	III PRIME	II	523
Lb-LANDSDALE SILT LOAM	IIe	PRIME	II PRIME	II	4,618
Lg-LLOYD LOAM	IIe	PRIME	II PRIME	II	416
Mg-MASADA	IIe	PRIME	II PRIME	II	576
Mh-MECKLENBURG	IIe	PRIME	III PRIME	II	1,368
Rc-RAPIDAN SILTY CLAY LOAM	IIe	PRIME	II PRIME	II	5,065
Sa-SENECA SILT LOAM	IIe	PRIME	II PRIME	II	2,227
Sc-STARR SILT LOAM	IIw	PRIME	III PRIME	I	6,476
Sd-STATE LOAM	IIw	PRIME	I PRIME	I	567
Wb-WADESBORO SILT LOAM	IIe	LOCAL	II PRIME	II	1,244
				SUB-TOTAL	***51,925***
FORESTAL SOIL:					
Bb-BUCKS SILT LOAM	IIIe	STATE	IV STATE	II	1,392
Eb-ELIOAK LOAM	IIIe	STATE	IV STATE	II	6,935
Fa-FAUQUIER SILT LOAM	IVe	STATE	IV STATE	I	770
Fb-FAUQUIER SILT LOAM	IIIe	STATE	IV STATE	I	1,618
Hc-HALEWOOD LOAM	IIIe	STATE	IV STATE	II	2,184
Hk-HELENA FINE SANDY LOAM	IIIe	LOCAL	III PRIME	II	274
Hm-HIWASSEE LOAM	IIIe	STATE	IV STATE	II	359
Hn-HIWASSEE LOAM	IIIe	STATE	IV STATE	II	1,081
Lf-LLOYDE LOAM	IIIe	STATE	IV STATE	II	901
Wa-WADESBORO SILT LOAM	IIIe	LOCAL	IV STATE	II	262
Ya-YADKIN LOAM	IIIe	LOCAL	IV STATE	II	702
				SUB-TOTAL	***16,478***
				TOTAL	**68,403**

HYDROLOGY

Surface Hydrology

The County of Culpeper lies wholly within the Rappahannock River basin. The County is drained by three major tributaries and their stream network into the Rappahannock River. The three major tributaries are the Hazel River, which drains the northwestern portion of the County; Mountain Run, which drains the central portion of the County and consists of several impoundments that were designed as multi-purpose lakes; and the Rapidan River, which drains the southeastern portion of the County and forms the County's southern boundary. The Rappahannock River itself forms the northern and eastern boundaries of Culpeper County and the confluence of the Rappahannock and Rapidan Rivers border the southeastern tip of the County. The County is also located in the non-tidal portion of the Chesapeake Bay Watershed. Approximately 2,075 acres of Culpeper County is covered by lakes, rivers and streams.

The 26 square mile portion of the Mountain Run watershed west of the Town of Culpeper contains Lake Pelham and Mountain Run Lake which serve as the primary water supply sources for the Town of Culpeper. These lakes are also used for recreation, including fishing and boating, although gas engines are prohibited. Mountain Run Lake was completed in 1959 and consists of an earth fill structure approximately 700 feet long and 40 feet high that impounds 611 acre-feet of which 531 acre-feet are reserved for water supply storage and 80-acre feet are reserved for sediment storage. The lake has a surface area of 75 acres. Lake Pelham was completed in 1972 and consists of an earth-fill structure about 1,000 feet long and 38 feet high. The dam impounds 1,924 acre-feet of which 1,000 acre-feet are reserved for water supply and 942 acre-feet are reserved for sediment storage. Lake Pelham has a surface area of 254 acres (Lake Pelham Watershed Management Plan, 1989 Espey, Houston & Associates). There are two additional lakes, Caynor and Merrimac, in the watershed that could possibly be considered for future water supply.

There are 16,542 acres in the drainage area for Lake Pelham, approximately 30% is suburban and 70% is agricultural and forestal. The location of the lakes west of the Town of Culpeper has increased growth pressures in this area thereby increasing the potential of point and non-point source pollution. To mitigate the adverse environmental impacts of this growth and associated development, the Town and County have developed a watershed management plan that will protect and enhance the water quality conditions within the watershed. The watershed protection policies, adopted by the Town and County, are reproduced in part at the end of the Environmental Section of this Comprehensive Plan. The following paragraphs provide a brief overview of the intent and purpose of the Watershed Protection Policies. See Maps 4.E and 4.F for the watershed and sub-basin boundaries.

The Town and County adopted the Watershed Protection Policies of 1990 to assure minimal degradation and to reduce the potential for deterioration of water quality in the Lake Pelham Watershed. This is to be achieved through the adoption of upper population limits as set out in the Lake Pelham Watershed Plan, limiting non-residential uses, encouraging clustering, requiring buffering along the lakes and their tributaries, restricting impervious areas, the provision of public sewer, adoption of a regional storm water management plan, farm plans for agricultural areas and the restriction of the storage and use of hazardous materials. The County adopted the Watershed Management District (WMD) Ordinance on March 3, 1992.

This Ordinance put into place numerous regulatory provisions, as mentioned above, to protect the Lake Pelham Watershed. Based upon the age of the WMD Ordinance, it is suggested that a review be undertaken to determine if changes are needed at this time. An emphasis should be placed upon water quality; not just quantity and Low Impact Development measures should be encouraged as a trade off for impervious surface limitations.

The combination of buffer strips and the creation of regional storm water detention ponds will help insure that the water quality of Lake Pelham and Mountain Run Lake will be protected. Natural vegetative buffers at least 200 feet in length will be provided along Lake Pelham and Mountain Run Lake. A minimum of 100 feet must be provided along primary creeks and streams that flow into Lake Pelham and Mountain Run Lake and at least 50 feet will be required along the secondary tributaries.

Several stream flow-gauging stations are maintained throughout the County. The U.S. Geological Survey publishes the data from these annually. Flow information coupled with water quality information can help determine the feasibility of water withdrawals or surface water impoundments along these streams and rivers.

Ground Water

Culpeper County is dependent upon groundwater for domestic, commercial and industrial use. A few areas adjacent to the Town of Culpeper utilize the Town's water system, otherwise, development is serviced by individual or community wells.

Culpeper County's groundwater lies in two aquifers, the Piedmont/Mesozoic basin aquifer and the Piedmont Blue Ridge crystalline aquifer. The Piedmont Mesozoic basin aquifer is composed of sandstone, siltstone, limestone and igneous intrusive rocks. The water in this aquifer is very hard and contains large concentrations of dissolved solids and sulfate. The Piedmont Blue Ridge crystalline aquifer is composed of intrusive igneous and metamorphic rocks. The water is generally acidic and has the smallest concentrations of dissolved solids, as do the principal aquifers in the State. The water is generally suited for most purposes, with varying degrees of hardness and iron depending on the mineral composition of the host rock. Ground water within the crystalline rocks of the Piedmont is stored in the pore spaces of the regolith (unconsolidated material overlying bedrock) and in the fractures in the underlying bedrock. Water within the sedimentary rocks of the Piedmont Mesozoic basin is stored in bedding plains, fractures and in pore spaces in the rock and regolith.

Groundwater is a vulnerable resource in which its quality is largely determined by how people use the land. Due to Culpeper County's dependence on groundwater, it is imperative that measures are taken to protect this resource. According to the Virginia Water Control Board, the most severe threats to groundwater quality come from leaking surface impoundments used to store, treat and recycle waste products; leaking underground storage-tanks; malfunctioning septic tanks and drain fields; improper uses and inadequate design of landfills; and agricultural use of fertilizers and pesticides.

There are several areas in the County that have been associated with potential groundwater contamination. Petroleum products have been identified in several wells along Business Route 15/29 at Inlet. The State Water Control Board studied this area and recommended

extending the Town water service to those residences and businesses with contaminated water supplies, which was done. A site off of Route 706 was identified as an EPA superfund site. Illegally buried barrels of chemicals were discovered and removed from the site. No well contamination resulting from this situation has been identified. The Brandy Station area has water quality problems that result from the combination of malfunctioning drain fields and shallow wells.

A groundwater protection program is being developed for the County to insure that this vital and limited resource is protected. This cannot be done effectively without the nature, location and hydrogeology of the groundwater in the County being fully evaluated. It is essential that a thorough, County-wide groundwater study be completed, and that groundwater protection ordinances be developed and implemented. A generalized program for groundwater protection through mandatory and voluntary BMP implementation; recycling programs for used oil and waste reduction in the landfill; household and farm hazardous waste cleanup days; and public education is currently attainable. In addition, the protection of surface and groundwater quality and quantity must be considered each time a land use change is proposed.

FLOODPLAIN

Flood prone areas in Culpeper County occur along all major streams as designated by the Flood Hazard Map (Map 4.C) developed from the 1987 HUD Flood Hazard Boundary Maps. Approximately 17,000 acres in Culpeper County are located in the 100-year floodplain. The Development Constraints Map (Map 4.D) also shows the approximate limits of the 100-year floodplain along with topographical and soils constraints

Land uses in the flood prone areas are subject to the provisions contained in the County's Floodplain Overlay District section of the County Zoning Ordinance. The Floodplain Overlay District outlines permitted uses, special uses and other regulations concerning development and structures within the 100-year floodplain areas. Culpeper County is also a participant in the National Flood Insurance Program that allows for the issuance of flood insurance and disaster assistance in the case of flooding.

TOPOGRAPHY

Culpeper County topography ranges from an elevation of 1160 feet above sea level on Mitchell's Mountain to 130 feet above sea level at the junction of the Rapidan
and the Rappahannock Rivers. In general, the land surface slopes southeastward from an average altitude of 600 feet above sea level in the western portion of the county to 350 feet in the southeast. The northwestern portion of the County is generally hilly to steep. The central portion of Culpeper County ranges from mostly level to rolling and the southeastern section of the County is rolling. There are numerous mountains designated in the County, the elevations of these are shown in Table 4.3.

TABLE 4.3
MOUNTAIN ELEVATIONS IN CULPEPER COUNTY

MOUNTAIN	ELEVATION
MITCHELLS MOUNTAIN	1,160
SCOTT MOUNTAIN	890
HITT MOUNTAIN	882
BRUCE MOUNTAIN	850
CEDAR MOUNTAIN	833
PARRISH MOUNTAIN	817
MOUNT PONY	790
FOX MOUNTAIN	762
BUZZARD MOUNTAIN	621
FLEETWOOD HILL	540
SHEADS MOUNTAIN	540
COLES HILL	510
HANSBROUGH'S RIDGE	470
STONY POINT	410

The Development Constraints Map (Map 4.D) designates those areas in the County that are located on slopes of fifteen percent (15%) and greater. These areas have development limitations and, accordingly, restrictions. Development and land disturbing activities, excluding agriculture, on 15-25% slopes should always require grading permits with erosion and sediment controls prescribed. Additionally, drain fields located on 15-25% slopes should require a hydrologic report assuring that ground and surface water will be protected both on and off-site. Those areas located on 25% or greater slopes should be restricted from development and drain fields should be prohibited.

WOODLAND FEATURES

Culpeper County has forested land in tracts that range from small privately owned wood lots to major parcels managed for commercial harvest. These woodlands not only provide raw materials for the forest industries but also provide benefits and amenities for all residents of the County. In addition to commercial timber opportunities, wooded areas also provide the following: watershed protection through storm water management and erosion control; aesthetic and scenic opportunities; air pollution and noise reduction; groundwater recharge areas; and recreation. Approximately 92% of the wooded areas in Culpeper County are in private ownership, 7% is commercial forestland. State and local government own the remaining 1%. According to the *Forest Statistics* for the Northern Piedmont of Virginia, (published 1986; Mark J. Brown, USDA Forest Service, Resource Bulletin SE-84), approximately 79% of the timberland in the County consists of hardwoods, 18% consists of pine, and 3% consists of soft hardwoods.

In 2004, approximately 32% of the County is wooded. Retention of this acreage will help ensure that the environmental quality of the community is protected. Areas that are managed for commercial timber operations should use best management practices and should enact a reforestation plan. Areas under development should provide plans that indicate preservation of the existing woodland features and re-vegetation of areas that are denuded in order to reduce the erosion, sedimentation, and storm water runoff impacts on downstream areas. Retention of existing woodlands on slopes greater than 15% should be required.

WETLANDS

Wetlands are transitional zones between open water and dry land. Non-tidal wetlands, as are those found within Culpeper County, often occur where water is found at or near the surface of the ground or in places where the ground is covered by shallow water ranging from a few inches to several feet. Some wetland areas are dry during certain seasons and flooding is common during the winter and spring when rivers overflow their banks. Nontidal wetlands include freshwater marshes and ponds, shrub swamps, bottomland hardwood forests, and wooded swamps and bogs.

Wetland Definition

The Federal Manual for Identifying and Delineating Jurisdictional Wetlands identifies three technical criteria that must be met for an area to be considered a wetland. These criteria are the presence of: 1.) hydrophytic vegetation, 2.) hydric soils and 3.) wetland hydrology.

Hydrophytic vegetation (Table 4.4) is defined as macrophytic plant life, which means water-loving plants that the naked eye can see growing in water or in soil or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. Plants that grow in wetlands are classified in two ways. One way is by their stratum, that is, whether they are trees, saplings, shrubs, vines, herbs or bryophytes (mosses and liverworts). The other way is according to their relative ability to live in either wetlands or uplands. If a plant is found only in wet areas, it is classified as ”obligate” (OBL). If it is found in either wetlands or uplands, it is classified as ”facultative” (FAC) and if it is facultative but is found more often in wetlands, it is considered to be “facultative wet” (FACW). Other plants are found only in uplands (UPL) or more often in uplands than in wet areas (FACU).

Hydric soils are saturated, flooded or ponded long enough during the growing season (usually between March and October in Culpeper County) to develop anaerobic conditions, that is oxygen deficient, in the upper layers. Wetland hydrology is characterized by flooding or saturation which is either permanent or which recurs for significant periods of time.

The U.S. Army Corps of Engineers, in cooperation with the EPA, administers wetlands through Section 404 of the Clean Water Act and has had the primary regulatory authority for preserving non-tidal wetlands in Virginia. The Corps must review any development plan that involves wetland areas and a permit to work in a wetland or a letter indicating that a permit is not necessary, must be obtained.

Wetland Preservation

In 1780, it is estimated that there were 220 million acres of wetlands in what is now the continental United States. In 1980, it was estimated that only 104 million acres of wetlands remained, and that we are continuing to loose wetlands at a rate of 100,000 to 300,000 acres per year.

Wetlands perform the following functions:

- By trapping waterborne sediment and its pollutants, wetlands protect the quality of surface waters. Therefore, the preservation of wetlands will help mitigate the water quality impacts that future development will have on the streams and lakes in Culpeper County.
- Wetlands also serve as a natural means of flood control; they absorb and store water during high-runoff periods, thereby reducing flood crests, and protecting life and property.
- Wetlands are critical at times of drought because they maintain critical base-flow to surface waters through the gradual release of stored flood-waters. Wetlands, therefore, can reduce the need to create the reservoirs and other water-storage facilities often constructed as a means to augment municipal water supplies.
- Some wetlands contain important, even unique, communities of wild plant and animal species. They also serve as temporary refuge for migratory birds such as ducks.
- Wetlands provide recreational benefits to hunters, fishermen, and campers, as well as open spaces to buffer incompatible uses.

- Wetlands are a valuable resource that must be preserved. Therefore, it will be the policy of Culpeper County to discourage the drainage or destruction of wetlands that meet the criteria as outlined in the Federal Manual for Identifying and Delineating Wetlands (or the most current federal identification and delineation policy). If such disturbance is unavoidable, the proper permits must be obtained from the Army Corps of Engineers. Innovative storm water management and Best Management Practices (BMPs) methods that preserve, establish and enhance wetland features will also be encouraged.

TABLE 4.4
CLASSIFICATION CHARACTERISTICS FOR WETLANDS: WETLAND PLANTS AND SOILS

TYPICAL DOMINANT PLANTS IN VIRGINIA'S WETLANDS:[1]

COMMON NAME	INDICATOR	COMMON NAME	INDICATOR
TREES:		HERBACEOUS PLANTS:	
RED MAPLE	FAC	SWEETFLAG	OBL
RIVER BIRCH	FACW	GIANT CANE	OBL
GREEN ASH	FACW	FALSE NETTLE	FACW
SWEETGUM	FAC	SEDGES	OBL OR FACW
WATER TUPELO	OBL	JOE PYE WEED	FACW (MOST)
BLACK GUM	FAC	MARSH HIBISCUS	OBL
SWAMP CHESTNUT OAK	FACW	IRISES (VARIOUS)	OBL
BALD CYPRESS	OBL	SOFT RUSH	FACW
SHRUBS:		SEEDBOX:	OBL (MOST)
HIGHBUSH BLUEBERRY	FACW	WATERLILIES	OBL
HAZEL ALDER	OBL	SENSITIVE FERN	FACW
BUTTONBUSH	OBL	CINNAMON FERN	FACW
SWEET PEPPERBUSH	FAC	ARROW ARUM	OBL
NORTHERN SPICEBUSH	FACW	COMMON REED	FACW
SWEETBAY MAGNOLIA	FACW	SMARTWEEDS SPP.	OBL
SOUTHERN WAXMYRTLE	FAC	PICKEREL WEED	OBL
WILLOWS (VARIOUS SP.)	FACW (MOST)	ARROWHEAD	OBL
VINES:		LIZARD'S TAIL	OBL
COMMON GREENBRIAR	FAC	CATTAIL SPP.	OBL

HYDRIC SOILS FOR CULPEPER COUNTY:[2]

ALTAVISTA: LIGHT-COLORED LOAM SOILS WITH A LIGHT YELLOWISH-BROWN CLAY LOAM SUBSOIL. THEY OCCUR ON SECOND BOTTOMS AND TERRACES ALONG THE LARGER STREAMS.

CHEWACLA: YELLOWISH-BROWN SURFACE SOIL AND A MOTTLED YELLOW, LIGHT-GRAY, AND BROWN SUBSOIL. SOMEWHAT POORLY DRAINED SOIL OCCURRING IN FIRST BOTTOMS.

CROTON: OCCURS THROUGHOUT THE TRIASSIC BASIN, CHARACTERIZED BY A LIGHT-GRAY TO YELLOWISH-GRAY SURFACE SOIL AND A MOTTLED SUBSOIL WHICH IS HIGHLY PLASTIC WHEN WET BUT HARD AND COMPACT WHEN DRY, ARTIFICIAL DRAINAGE IS REQUIRE TO GROW CROPS.

ELBERT: LOCALLY KNOWN AS WET BLACKJACK LAND, IS CHARACTERIZED BY POOR SURFACE AND INTERNAL DRAINAGE, NUMEROUS MOTTLINGS THROUGHOUT THE PROFILE, AND A VERY HEAVY PLASTIC SUBSOIL.

HELENA: FINE SANDY LOAM THAT WHEN COMPARED TO APPLING IS MUCH HEAVIER AND HAS MOTTLED SUBSOIL. OCCURS IN ASSOCIATION WITH WILKES AND APPLING SOILS.

IREDELL: LOCALLY KNOWN AS BLACKJACK LAND, OCCURS AS LEVEL TO GENTLY ROLLING AND CHARACTERIZED BY LIGHT-GRAY SILTY SURFACE SOIL AND VERY HEAVY PLASTIC CLAY SUBSOIL. SURFACE DRAINAGE RANGES FROM FAIR TO POOR AND INTERNAL DRAINAGE IS VERY SLOW.

KELLY: BROWNISH-GRAY SILT LOAM SURFACE SOIL WITH A VERY HEAVY PLASTIC CLAY SUBSOIL.

LANSDALE: (0-2% SLOPE ONLY) SURFACE SOIL IS WEAK YELLOW TO PALE BROWN. THE SUBSOIL IS LIGHT YELLOWISH BROWN. THE LEVEL PHASE (SLOPES 0 TO 2 %), IS POORLY DRAINED.

LIGNUM: UNDERLAIN BY AND DERIVED FROM VERY FINE-GRAINED SERICITIC SCHIST.

MIXED ALLUVIAL: TEXTURE VARIES FROM SILT LOAM TO SAND AND THE SOILS RANGE FROM WELL TO POORLY DRAINED. THE LARGEST AREAS ARE IN THE BIG BENDS OF THE STREAMS AND ARE SUBJECT TO FREQUENT OVERFLOW AND DEPOSITION.

ROANOKE: OCCURS ADJACENT TO UPLANDS ON THE LOW TERRACES ALONG THE RIVERS. WATERLOGGED DURING THE WET SEASONS.

SENECA: USUALLY OCCURS IN ASSOCIATION WITH APPLING, ALBEMARLE, ETC. AND IS DERIVED FROM RECENT ALLUVIAL COLLUVIAL MATERIALS SLOUGHED AND WASHED DOWN FROM THEM. INTERNAL DRAINAGE IS MODERATE TO MODERATELY SLOW.

STANTON: DEVELOPED FROM BROWN, YELLOW AND GRAY TRIASSIC SHALES IN CLOSE ASSOCIATION WITH CROTON, LANDSDALE, ETC. SOIL CHARACTERISTICALLY HAS POOR DRAINAGE.

WEHADKEE: OCCURS IN FIRST BOTTOMS ALONG STREAMS AND IS LIGHT-COLORED WITH MOTTLED SUBSOIL.

WORSHAM: OCCUPIES AREAS AT THE BASE OF SLOPING AREAS BORDERING STREAMS, IS A POORLY DRAINED SOIL.

(1)CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT.
(2)USDA SOILS SURVEY - CULPEPER COUNTY, VIRGINIA, SERIES 1941, NO. 3.

ENDANGERED SPECIES

The Virginia Natural Heritage Program was established in 1986 and in 1988 became an organizational component of the Virginia Department of Conservation and Recreation in the Division of Natural Heritage. Natural heritage resources (NHR's) are defined by the Virginia Natural Area Preserves Act as "the habitat of rare, threatened, or endangered plant and animal species, rare or state significant natural communities or geologic sites, and similar features of scientific interest." The Virginia Department of Game and Inland Fisheries and the Virginia Department of Agriculture maintain the lists for these species.

Based upon the current listing of the Virginia Department of Game and Inland Fisheries there is only one specie in Culpeper County on the federal and state “threatened” list: the American Bald Eagle. The state “threatened” list also includes the Loggerhead Shrike and the Upland Sandpiper, but these have not been identified in Culpeper County. The ‘threatened’ category has a legal status and federal protective policies apply. A species carrying the ‘special concern’ designation does not have legal status but habitats are to be protected to the extent practicable. Currently, the species of special concern status known or likely to occur in Culpeper County are:

- Caspian Tern,
- Common Moorhen,
- Red-breasted Nuthatch,
- Brown Creeper,
- Winter Wren,
- Northern Harrier,
- Great Egret,
- Barn Owl,
- Hermit Thrush,
- Golden Crowned Kinglet,
- Magnolia Warbler,
- Purple Finch,
- Dickcissel,
- Northern River Otter

Special attention should be taken to facilitate the protection of endangered species whenever reasonably possible.

LAND CAPACITY / DEVELOPMENT CONSTRAINTS

The Development Constraints Map (Map 4.D) identifies both areas that are restricted from building and those with building limitations. This is a generalized map that approximates those areas with development constraints. The map is not intended to be site specific nor all-inclusive. Site-specific information should be provided for any development project that encounters areas with building restrictions.

The one-hundred year floodplain is specific category an area of building restriction. The allowable activities in a floodplain area include agricultural uses, public and private

recreational uses, accessory residential uses such as yards and gardens, and accessory industrial and commercial uses to include yard areas, pervious parking areas and airport landing strips.

Soil properties are measured in terms of depth to water table, ease with which water filters through, moisture retention capacity, stability with changes in temperature and moisture content, acidity (ph), corrosiveness and a variety of other criteria. The relative importance of each criteria varies with the contemplated use. Specifically, we rely on our home sites to provide both drinking water and to clean wastes. The areas designated as unsuitable for drain fields are those in areas where the soils have high shrink-swell potential or shallow depth to bedrock. These soils include Iredell, Elbert, Zion, Mecklenburg, Orange, Lignum, Catoctin, Aldino and Penn soils. In general, the soils with the greatest building limitations are found in the Triassic Basin. Slope is also designated as both a limiting and restrictive development factor.

WATERSHED PROTECTION: GENERAL

Chesapeake Bay Act

With the advent of the Chesapeake Bay Preservation Act (the Bay Act), enacted in 1988 by the State legislature, a program of watershed management was initiated designed to restore the once pristine water quality afforded the Chesapeake Bay. Stringent guidelines and enforcement measures were set in place to manage tributaries leading to the Bay. These measures impacted private citizenry, private industry and public policy much to the overall improvement of the Bay.

The implementation of measures taken from the Bay Act may be advisable to improve water quality over time.

Storm Water Management Ordinance

As development continues to increase within the County the impermeable surfaces continue to increase, resulting in higher runoff. The overall result is greater quantities and higher velocities of runoff. The County is preparing a Storm Water Management Ordinance to accommodate these higher capacities of runoff during high intensity rainfall events. A Storm Water Management Ordinance is currently being reviewed to enhance both runoff capacities, the impact of high intensity rainfall events and resulting overall water quality. An appropriate Storm Water Maintenance Ordinance must be in place to implement low impact development.

Low Impact Development

The County is currently conducting studies regarding low impact development, which utilizes the latest considerations for on-site storm water management and control measures. Low impact development considers the impact of rainfall events and attempts to utilize the environment to bring about storm water controls that are effective and environmentally friendly. For example, infiltration trenches and rain gardens may be used to create aesthetically pleasing landscaping and water features.

WATERSHED PROTECTION: LAKE PELHAM AND MOUNTAIN RUN LAKE WATERSHEDS

On March 3, 1992, the Culpeper County Board of Supervisors adopted Article 8C *Watershed Management District (WMD)*, into the Culpeper County Zoning Ordinance. The WMD is an overlay zone specific to the Mountain Run Lake - Lake Pelham Watershed. The Ordinance seeks to implement the policies that follow. The maximum densities allowable, as well as other aspects of the ordinance, differ slightly from the policies listed below. As with all of the guidelines set forth in this Comprehensive Plan, these policies are general in nature, and implementation must be undertaken with many considerations in mind, and at the discretion of the Board of Supervisors.

General Policy

1. The County seeks to outline a set of general policies (goals) and specific or implementing policies (or objectives) which will achieve the protection of the public health and safety and the assurance of minimal degradation and the prevention of future deterioration in the water quality in the Lake Pelham watershed.

2. Any strategy for improving the water quality will seek to keep the costs from the preservation or enhancement of the water quality below the benefits from achieving the same. In considering benefits, the County will fully consider the costs to the public health from damage to the water supply and where necessary attempt to quantify the same.

3. In determining whether the water quality of the water supply is being maintained, the County will examine the following water quality parameters: (1) the amount of nitrogen, phosphorous, solids, and the effect on dissolved oxygen; (2) the amount and concentration of the following metals and toxics: arsenic, cadmium, chromium, lead, mercury and zinc.

Specific or Implementation Policies

1. The County hereby establishes upper population limits not exceeding the levels set out in Scenario II, as set out in the Lake Pelham Watershed (LPW) Plan, for purposes of establishing a guide or limit to the types and intensities of uses in the LPW.

2. Because non-residential uses, particularly commercial and industrial uses, involve considerable threats of toxin and metal pollution, both from their own wastes and from heavy auto travel associated with the uses, non residential development, other than what already exists or is planned should be limited. Non-residential uses, other than parks, schools, churches and other community facilities, and those public facilities that must locate in the LPW in order to serve development that has or is likely to locate there, shall be required to provide storm water management facilities and Best

Management Practices (BMPs), which insure water quality will not be degraded.

3. The average overall density for residential development in any sub-area as set out in the LPW Management District shall not exceed the density for the full area unless adjustments are made to another sub-area which would result in the same or lesser overall impact being achieved.

4. Cluster styles of development, such as cluster subdivisions, planned residential developments, architecturally integrated developments, and planned unit developments, offer the opportunity, although not the certainty, that the development will pose the least adverse impact on the water supply. Clustering provides an opportunity to improve the use of open space for filtering and to avoid highly erodible soils or steep slopes or other areas where impacts could be difficult to control. The County acknowledges that cluster styles of development that are designed to protect the water supply are the preferred method of development in the LPW.

5. The County will require that developments using clustering demonstrate that densities are actually increasing as they move further from the lakes and primary creeks and streams, or that the developments have been specifically designed to maximize the effectiveness of local wet ponds.

6. Natural vegetated buffer areas allow an opportunity to filter out soils and particles before they reach the water supply. Since many pollutants travel in association with these particles, the filtering mechanism is a proven way to reduce pollution in the water supply.

7. In order to protect the water supply the County will require that a natural vegetated buffer areas of at least 200 feet be provided along Lake Pelham and Mountain Run Lakes, at least 100 feet shall be provided along primary creeks and streams leading into those Lakes and at least 50 feet shall be provided along tributaries to the lakes and to those creeks and streams. Adequate mechanisms are needed in development proposals to insure that these areas remain and be maintained in a natural state.

8. At the heart of the watershed protection plan is a reliance on wet ponds and other best management practices with a potential to engineer at the site and regional levels a system that will protect the water supply. The amount of runoff in the LPW is directly related to the amount of impervious surface. The quality of that runoff is directly related to the use and intensity of the land uses. The County will modify development standards to require that developments utilize best management practices, limit the amount of grading in development to only that which is necessary to put roads, utilities, driveways, parking areas, principal structures, necessary accessory structures and a reasonable amount of activity space in place.

9. Because the principal problem anticipated in the Lake Pelham watershed is nitrification, development of public sewer is encouraged. On-lot sewage disposal, while not preferred, is acceptable at the densities and with the buffers set out. Alternative methods of sewage disposal, such as package plants, have become synonymous with operational and maintenance problems which if they occurred in the watershed could threaten our water quality. Because of these concerns, alternative methods of sewage

are discoureaged.

10. The Lake Pelham Watershed is susceptible to pollution from failed drain fields or highly concentrated pollutant loadings, especially in areas directly abutting Lake Pelham, or within direct storm water access. In order to avoid future lake degradation policies shall be implemented which properly restrict septic systems in the Lake Pelham area. Beneficial development should be encouraged to locate and phase into the areas designated for service by public water and sewer. The County shall encourage those developments in the Lake Pelham area which can reasonably be served by Town water and sewer, or to wait for the availability of those services.

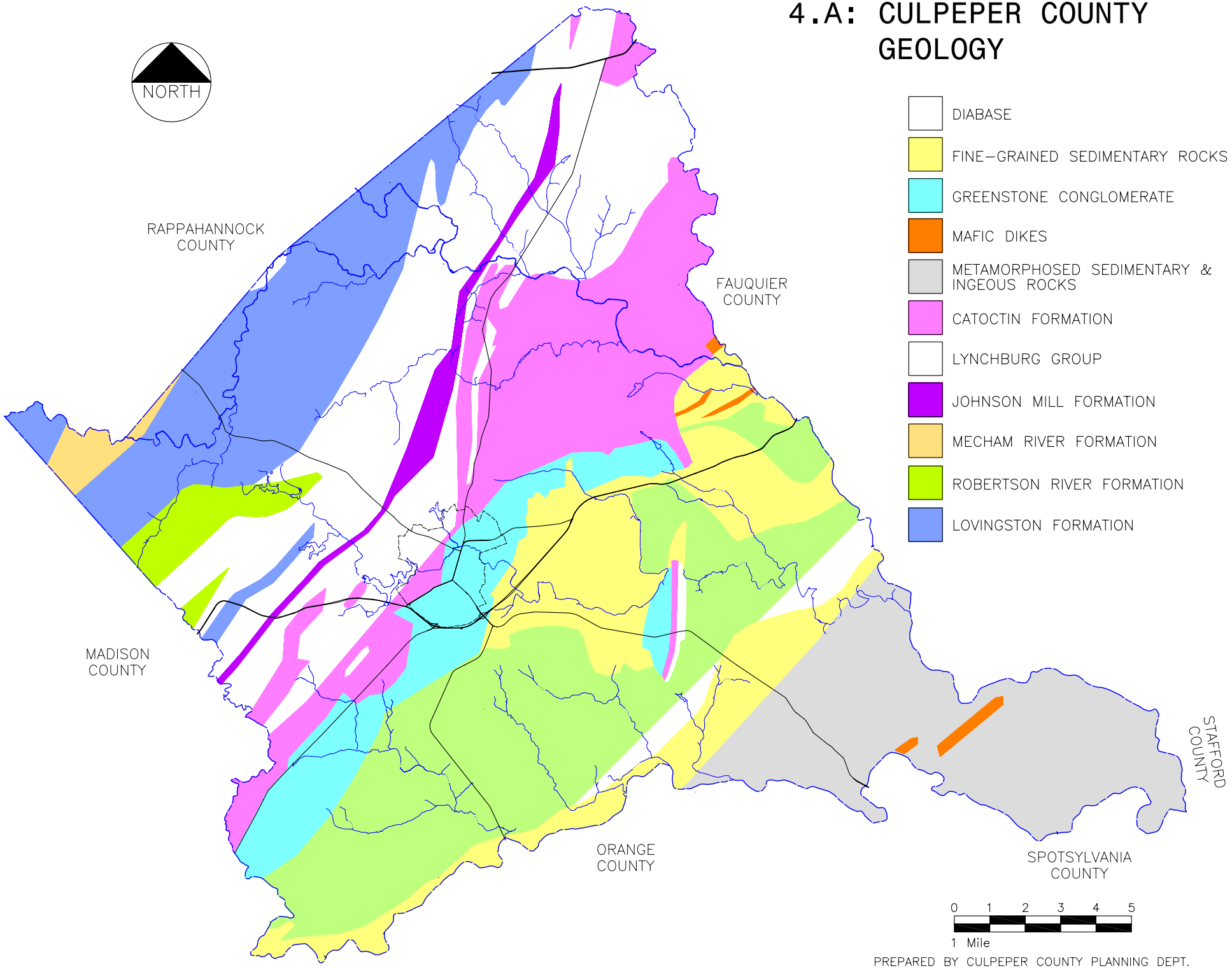
11. The County believes that water quality would benefit from a regional BMP approach to a regional storm water management plan. Such an approach allows for public maintenance of a few select protection devices. To achieve that end, the County has identified three areas for regional wet ponds. Efforts will be undertaken to obtain rights to use the land under the proposed ponds for these types of facilities.

12. The Town and County require Erosion and Sediment Control Plans for land disturbing activities of greater than 5,000 sq. ft. in the WMD.

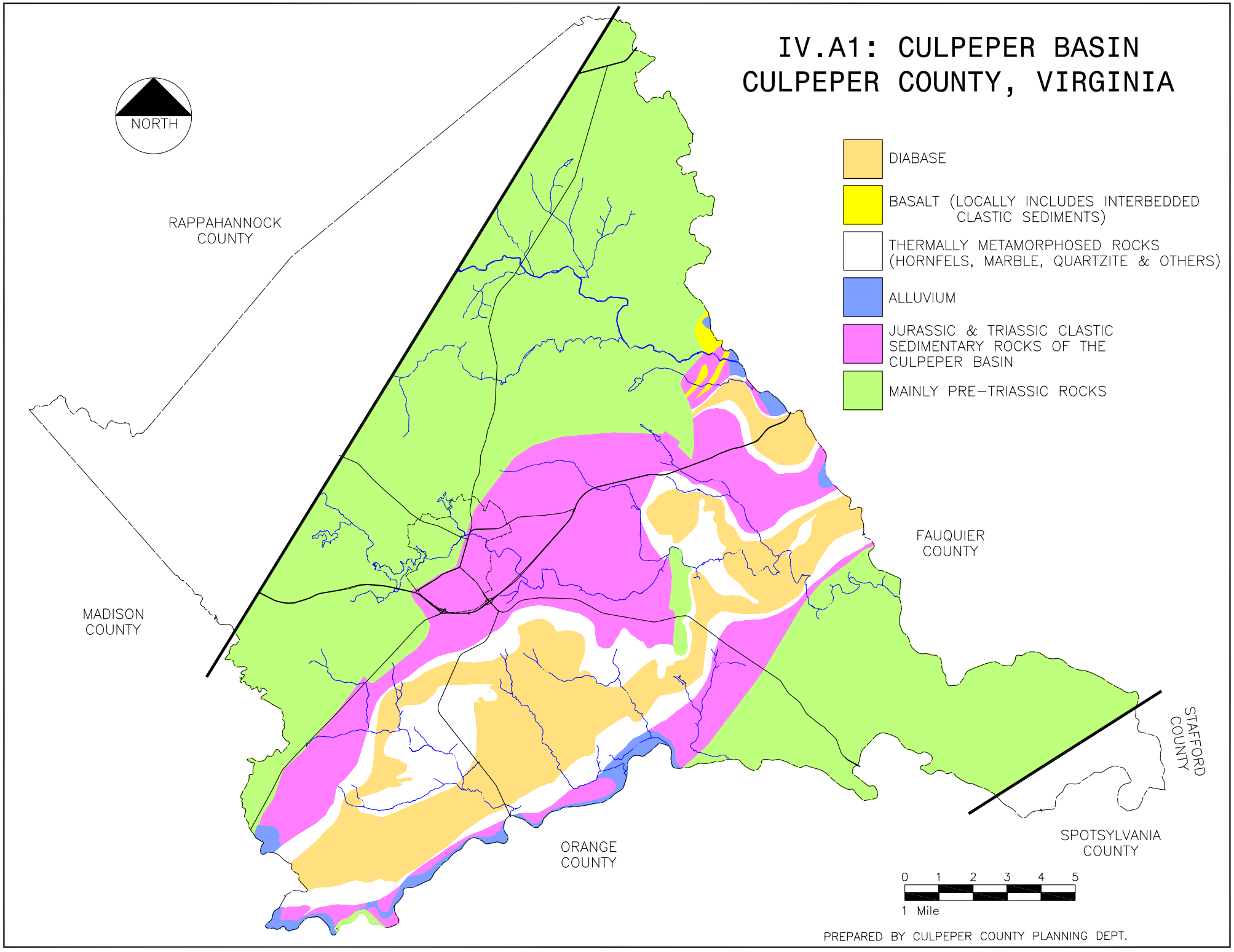
13. Lake Pelham and Mountain Run Lake are highly susceptible to degradation from hazardous substances that might enter the drinking supply from a spill, surface runoff or groundwater leachate. Under current law, persons possessing hazardous substances must file a report with the Culpeper County Department of Emergency Management. The possession of hazardous materials in excess of the filed report must also be reported to the same County Department. The County will undertake additional efforts to gain compliance with existing law in the LPW and restrict the use and storage of hazardous material. In addition, the County will work to develop procedures for the avoidance of hazardous spills and critical response in the event of an incident.

14. The County will establish an inventory of natural boundaries indicating areas that must be preserved to insure that water quality of Lake Pelham is preserved. This inventory should identify wetlands, stream and lake buffers, floodplain, highly permeable soils, and other land necessary to protect water quality.

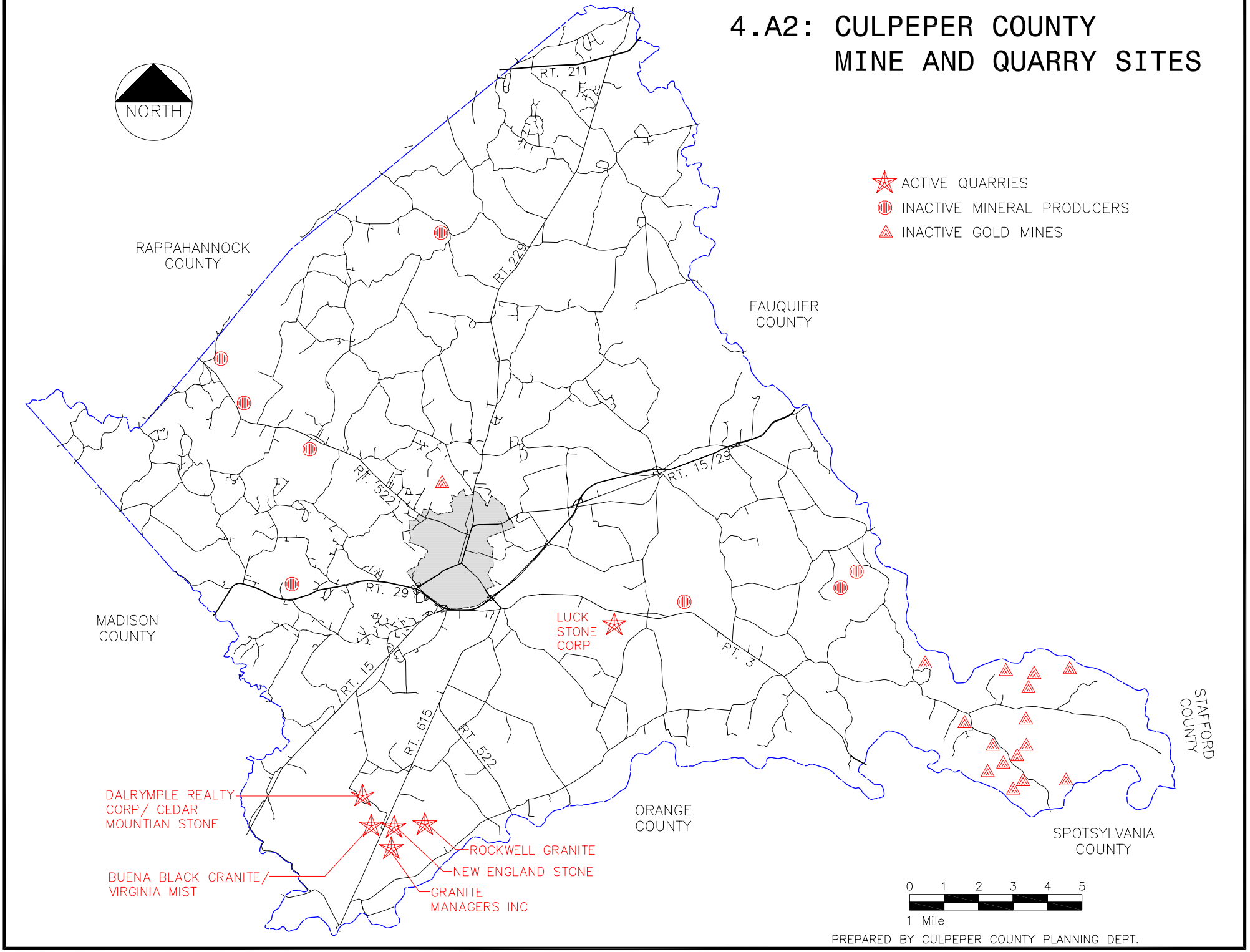
4.A: CULPEPER COUNTY GEOLOGY



PREPARED BY CULPEPER COUNTY PLANNING DEPT.

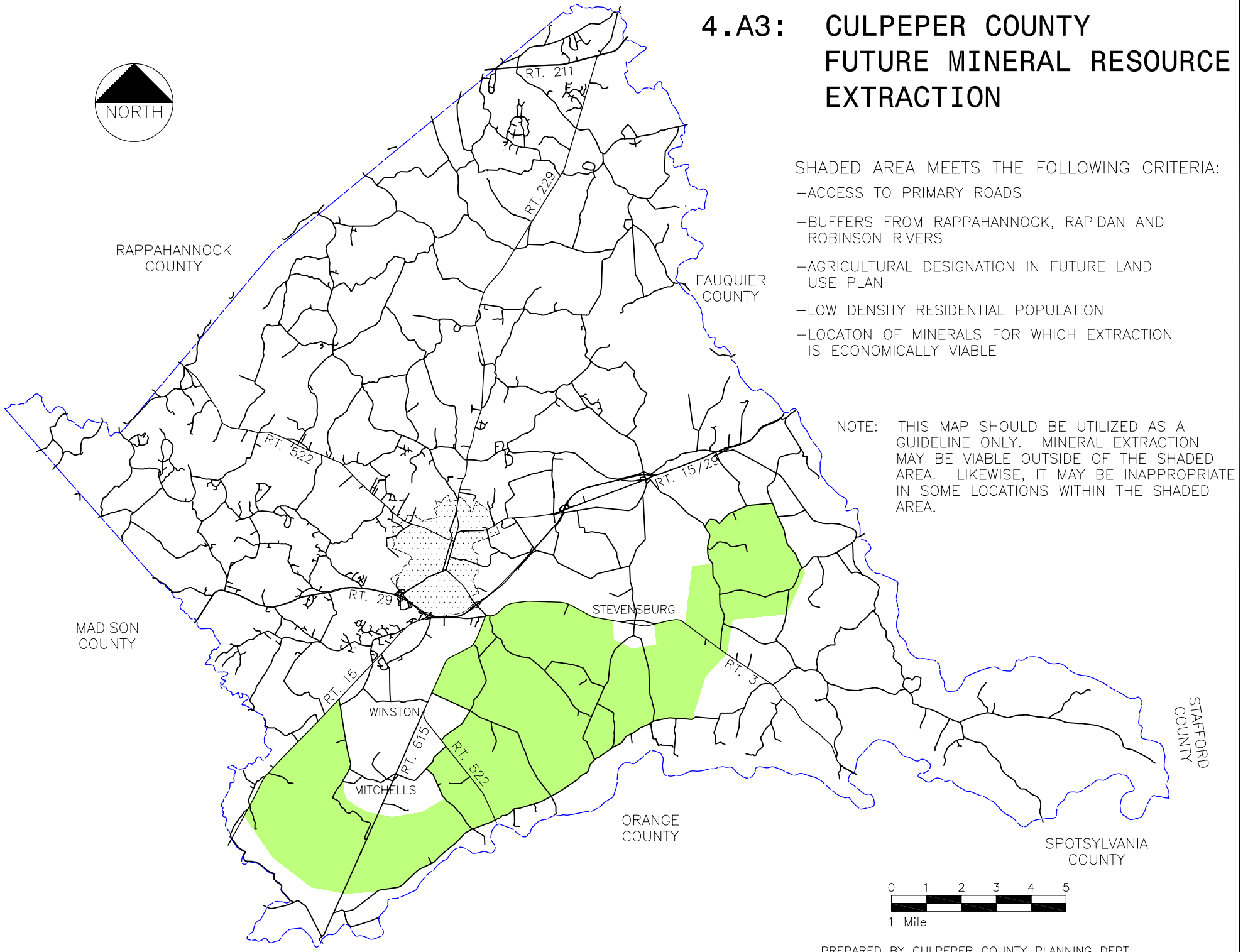

IV.A1: CULPEPER BASIN
CULPEPER COUNTY, VIRGINIA
NORTH
RAPPAHANNOCK COUNTY
MADISON COUNTY
FAUQUIER COUNTY
ORANGE COUNTY
SPOTSYLVANIA COUNTY
STAFFORD COUNTY
DIABASE
BASALT (LOCALLY INCLUDES INTERBEDDED CLASTIC SEDIMENTS)
THERMALLY METAMORPHOSED ROCKS (HORNFELS, MARBLE, QUARTZITE & OTHERS)
ALLUVIUM
JURASSIC & TRIASSIC CLASTIC SEDIMENTARY ROCKS OF THE CULPEPER BASIN
MAINLY PRE-TRIASSIC ROCKS
0 1 2 3 4 5
1 Mile
PREPARED BY CULPEPER COUNTY PLANNING DEPT.

4.A2: CULPEPER COUNTY MINE AND QUARRY SITES



PREPARED BY CULPEPER COUNTY PLANNING DEPT.

4.A3: CULPEPER COUNTY FUTURE MINERAL RESOURCE EXTRACTION



SHADED AREA MEETS THE FOLLOWING CRITERIA:

- ACCESS TO PRIMARY ROADS
- BUFFERS FROM RAPPAHANNOCK, RAPIDAN AND ROBINSON RIVERS
- AGRICULTURAL DESIGNATION IN FUTURE LAND USE PLAN
- LOW DENSITY RESIDENTIAL POPULATION
- LOCATON OF MINERALS FOR WHICH EXTRACTION IS ECONOMICALLY VIABLE

NOTE: THIS MAP SHOULD BE UTILIZED AS A GUIDELINE ONLY. MINERAL EXTRACTION MAY BE VIABLE OUTSIDE OF THE SHADED AREA. LIKEWISE, IT MAY BE INAPPROPRIATE IN SOME LOCATIONS WITHIN THE SHADED AREA.

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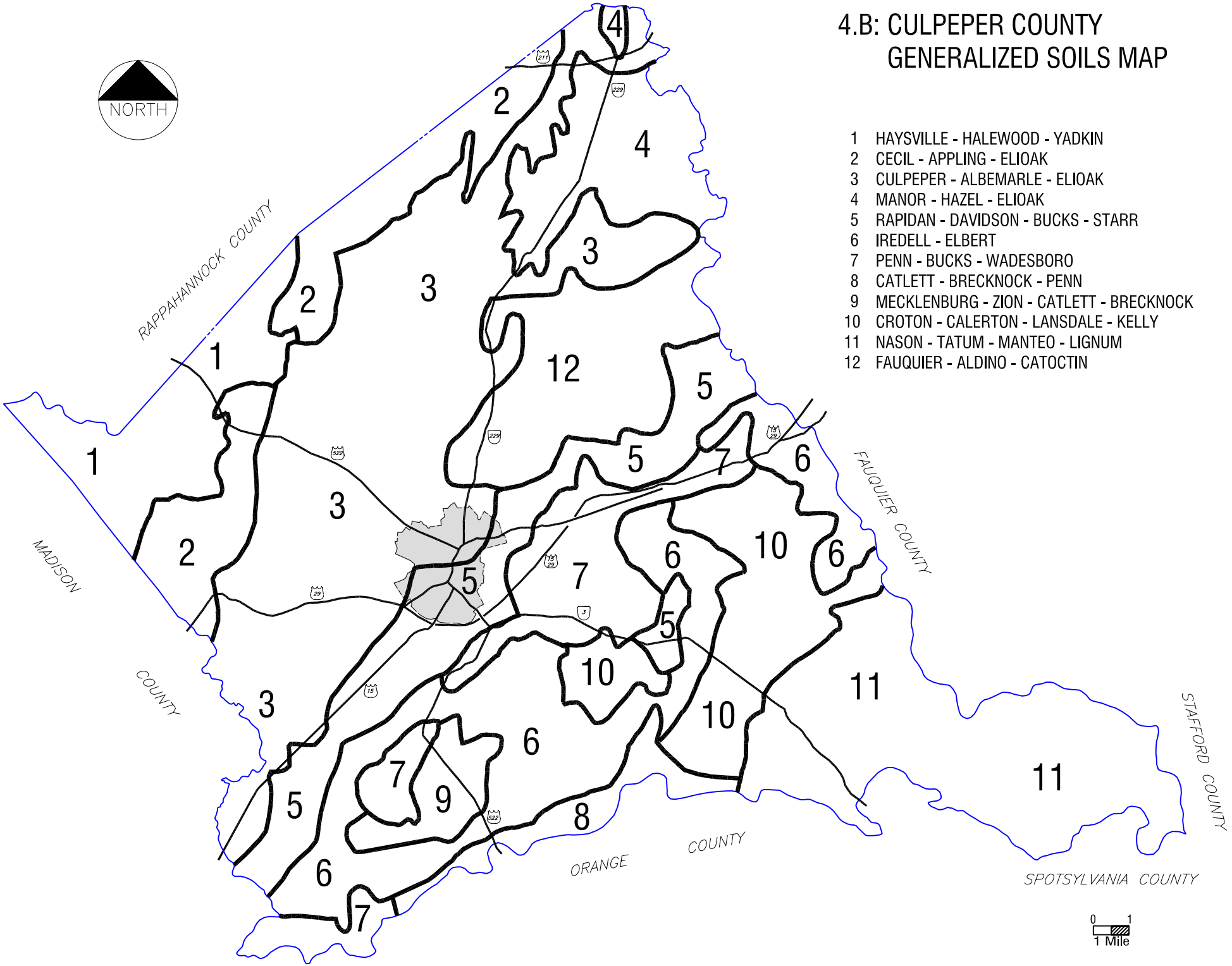
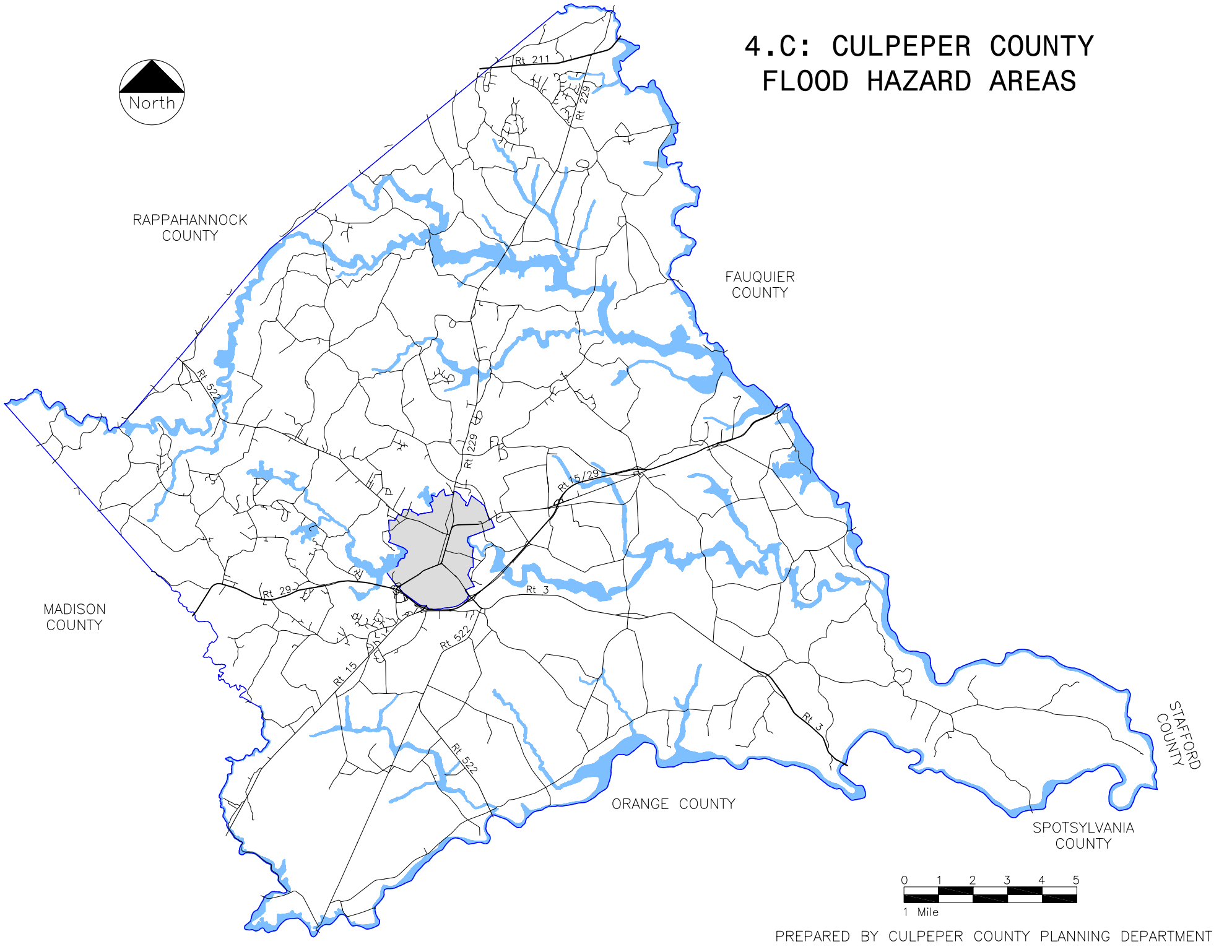
4.B: CULPEPER COUNTY GENERALIZED SOILS MAP



1 HAYSVILLE - HALEWOOD - YADKIN
2 CECIL - APPLING - ELIOAK
3 CULPEPER - ALBEMARLE - ELIOAK
4 MANOR - HAZEL - ELIOAK
5 RAPIDAN - DAVIDSON - BUCKS - STARR
6 IREDELL - ELBERT
7 PENN - BUCKS - WADESBORO
8 CATLETT - BRECKNOCK - PENN
9 MECKLENBURG - ZION - CATLETT - BRECKNOCK
10 CROTON - CALERTON - LANSDALE - KELLY
11 NASON - TATUM - MANTEO - LIGNUM
12 FAUQUIER - ALDINO - CATOCTIN

4.C: CULPEPER COUNTY
FLOOD HAZARD AREAS



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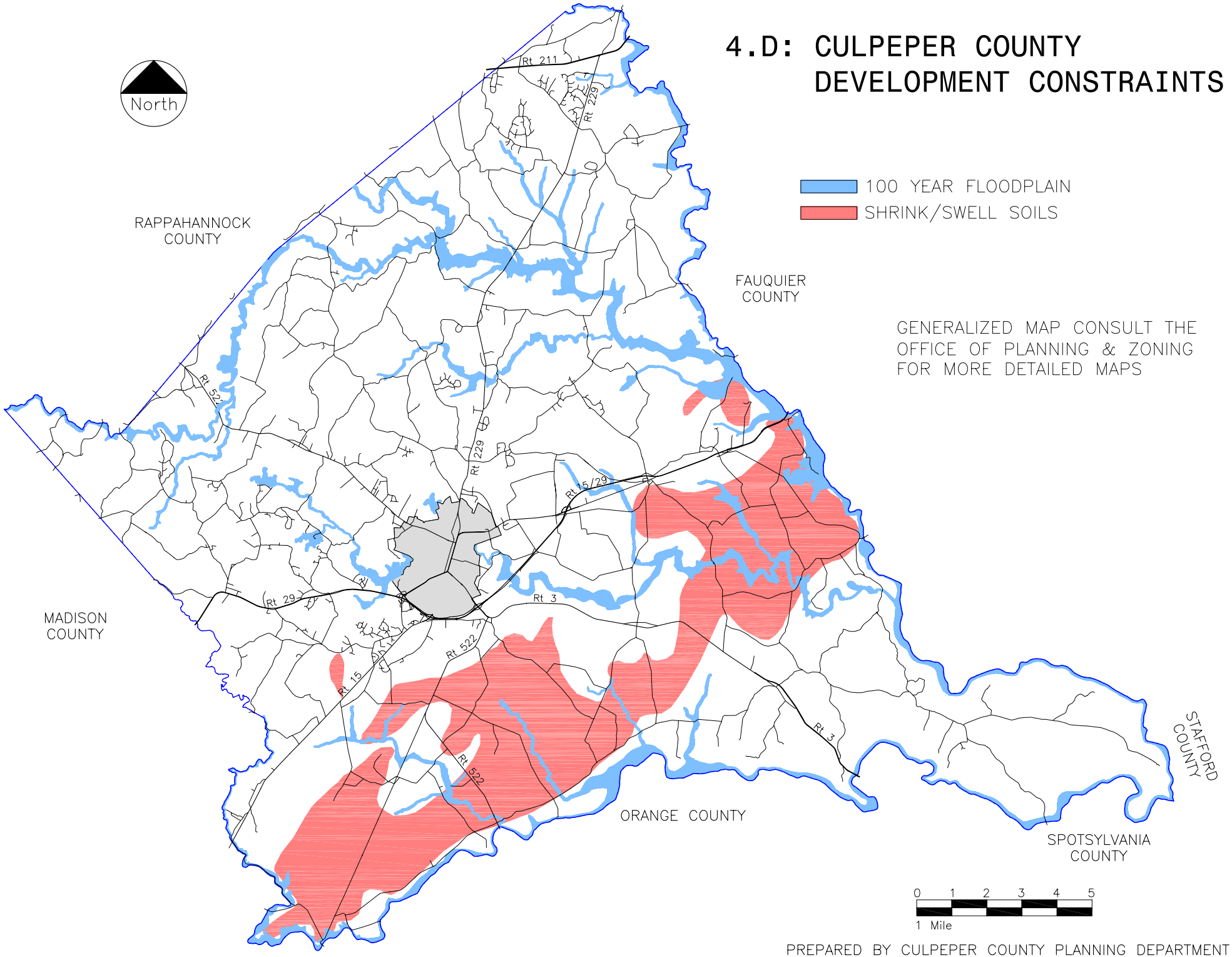
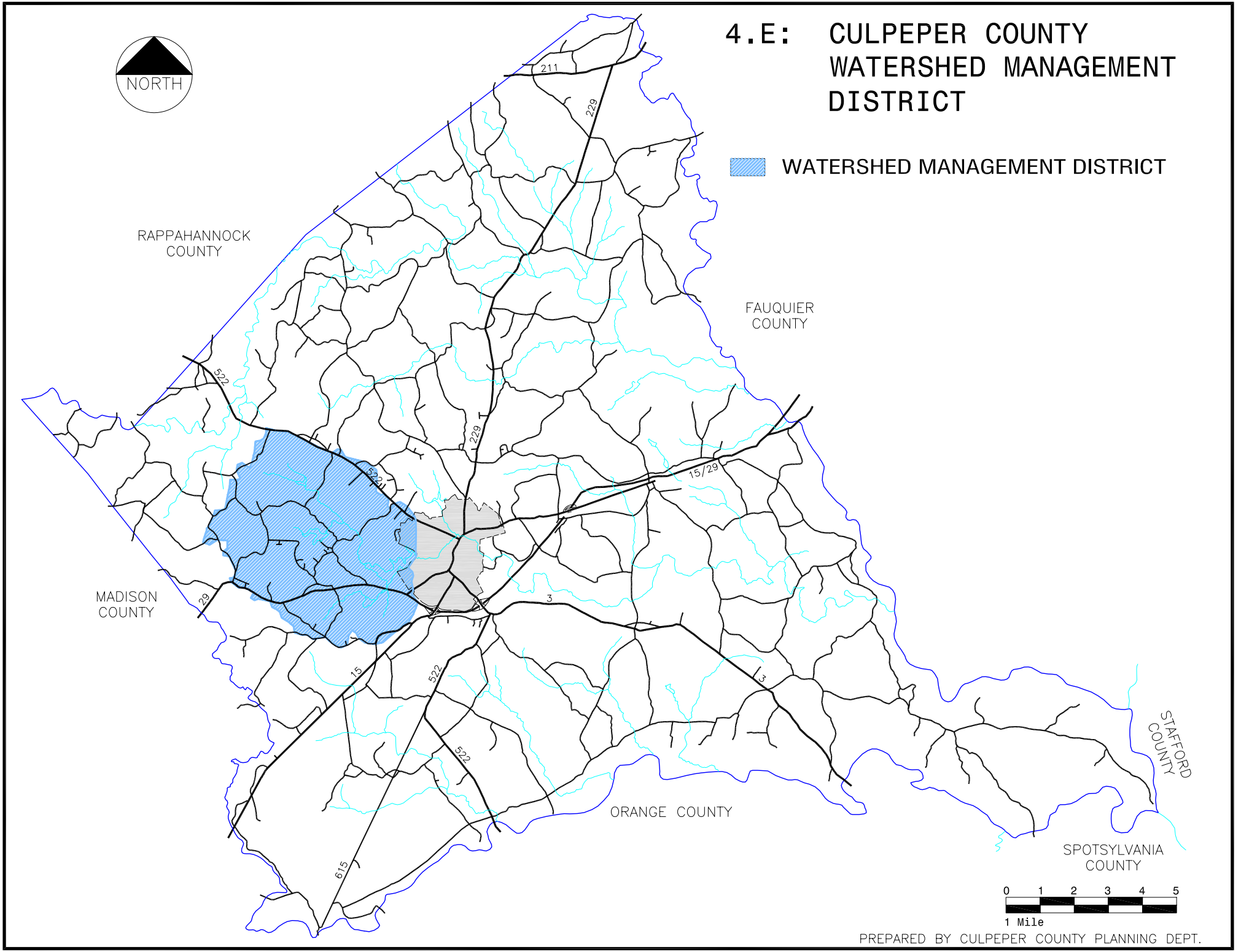
4.D: CULPEPER COUNTY DEVELOPMENT CONSTRAINTS



GENERALIZED MAP CONSULT THE OFFICE OF PLANNING & ZONING FOR MORE DETAILED MAPS

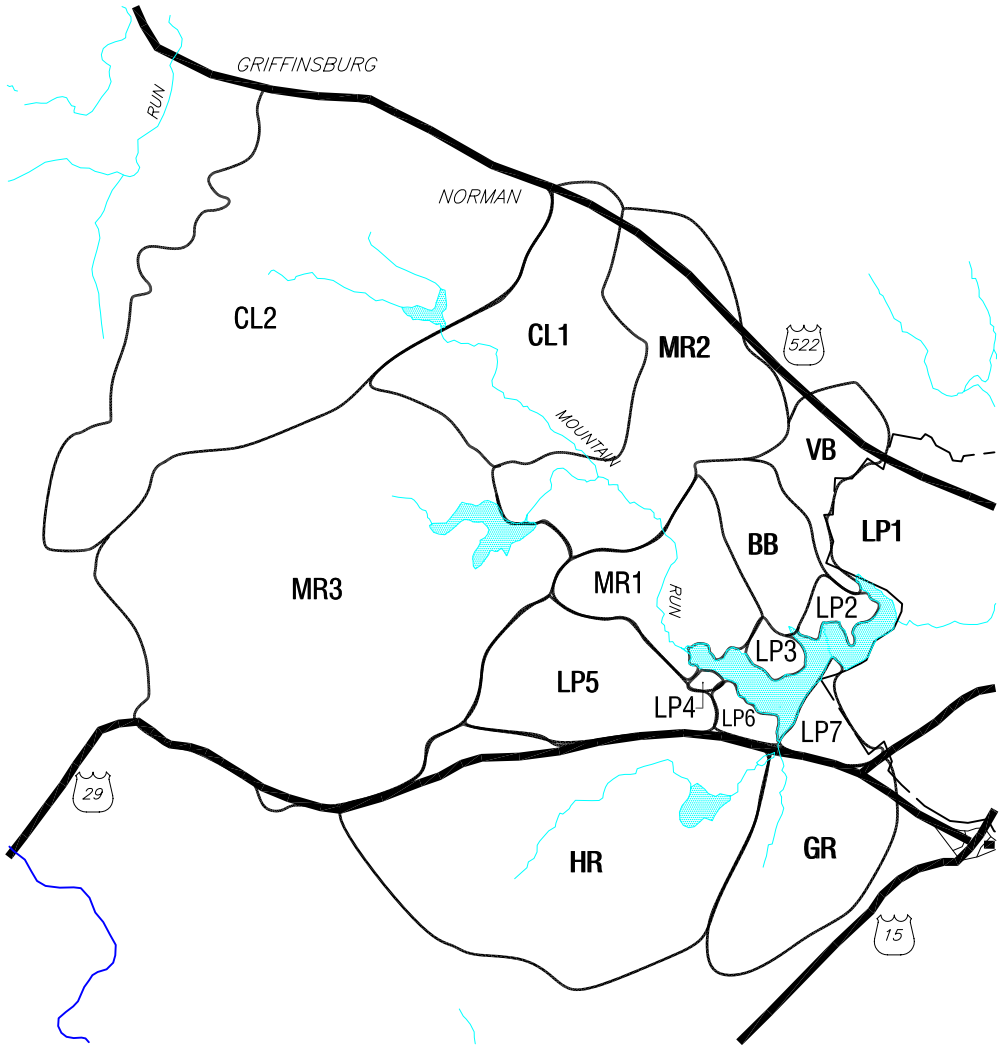
PREPARED BY CULPEPER COUNTY PLANNING DEPARTMENT

4.E: CULPEPER COUNTY WATERSHED MANAGEMENT DISTRICT



PREPARED BY CULPEPER COUNTY PLANNING DEPT.

4.F: LAKE PELHAM & MOUNTAIN RUN LAKE: DRAINAGE SUB-AREA DESIGNATIONS



DRAINAGE SUB-AREA DESIGNATION

BB - BOND BRANCH
CL - CAYNOR LAKE
GR - GAINES RUN
HR - HUNGRY RUN
LP - LAKE PELHAM
MR - MOUNTAIN RUN
VB - VAUGHN BRANCH